


NUCLEONICA: Dosimetry & Shielding

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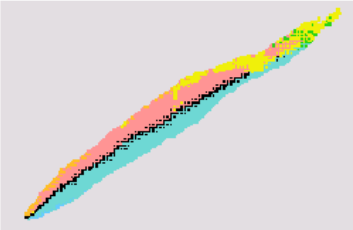
Nuclear science applications...



... web driven nuclear science


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» Actual Chart: Karlsruhe

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MyCommunity Portal



> My Last Nuclides

-  90 Th232
-  90 Th231
-  94 Pu239
-  92 U235
-  25 Mn52






> My Nuclide Mixtures

-  Pu238+daughter (100g @50y)
-  Natural Uranium
-  Cs137 + Ba137m
-  U232+Co60
-  Transuranics in 1 ton Spent Fuel (4.2% enriched, 50GWd/t, 6 years cooling)

> My Sources


-  Pu239 1 g
-  natu

> My Messages

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-  Open call for JRC Traineeships at the Institute for Transuranium Elements
-  NAMLS-9 International Conference on Nuclear Analytical Methods in the Life Sciences


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> User Alerts

-  Task completed (DecayEngine: Uranium 238)

» View

Dosimetry & Shielding:

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Applications My Preferences Print **Help**


Co60

10.47 m 5.27 y

Dosimetry and Shielding

27 Cobalt

Current Chart: Karlsruhe

Element: Co Mass: 60  Nuclide Mixtures Selector

Dosimetry and Shielding

Dose rate/Thickness graph Options

Source strength


Activity(Bq) 1E+06

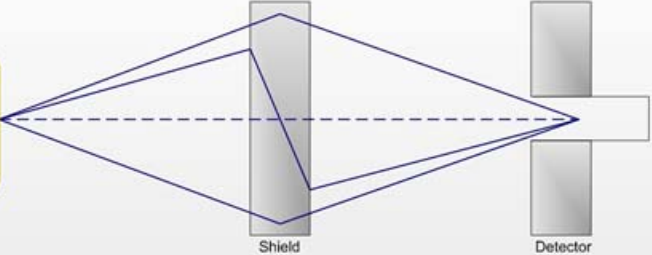
Shielding material


Pb 1 cm

Dose rate ($\mu\text{Sv/h}$)

???


Source


Shield


Detector

Source/detector distance (cm)

100

 [wiki]

Magill my talk preferences my watchlist my contributions

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Help:Dosimetry & Shielding

In this section the formalism for dosimetry and shielding calculations is developed. In the following sections a brief description of the interaction of radiation with matter is given together with the physical basis of radiological dosimetry and shielding.

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1 Biological Effects of Ionising Radiation

2 Absorbed Dose

2.1 Quality or Weighting Factor

2.2 Equivalent Dose

2.3 Effective Dose

2.4 Committed Effective Dose, $E(t)$

2.5 Collective Effective Dose

2.6 Radiotoxicity and Annual Limits of Intake (ALI)

2.7 Radiation Hormesis and the Linear Non-Threshold (LNT) Model

3 Attenuation of Gamma Radiation

4 Absorption of Gamma Radiation

5 Calculation of the Equivalent Dose Rate

6 Absorption in Tissue

6.1 Data for Tissue

7 Attenuation in Shield Materials

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7.2 Concrete

7.3 Iron

7.4 Tin

7.5 Tungsten

7.6 Uranium

7.7 Water

7.8 Aluminum

7.9 Air

7.10 Tissue

8 Build-up Factors (B) for Shield Materials

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Co60
10.47 m 5.27 y

Dosimetry and Shielding

27 Cobalt

Current Chart: Karlsruhe

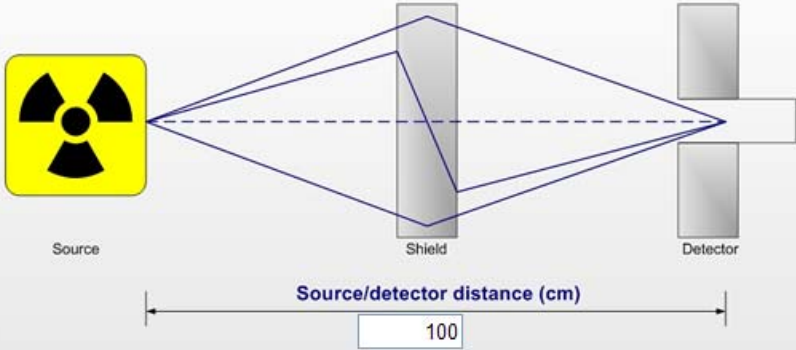
Element: Co Mass: 60 Nuclide Mixtures Selector

Dosimetry and Shielding Dose rate/Thickness graph **Options**

Source strength Activity(Bq) 1E+06

Shielding material Pb 1 cm

Dose rate ($\mu\text{Sv/h}$) ???



Source/detector distance (cm) 100

Start Reset

Element: Co Mass: 60 Nuclide Mixtures Selector

Dosimetry and Shielding Dose rate/Thickness graph **Options**

Dosimetry and Shielding Settings

Energy range option:

- ☐ Only Gamma ☐ Only X-rays ☒ Gamma and X-rays
- ☒ Threshold set

Threshold energy (keV): 15

Result Detail option: ☐ Show Nuclides

Mode of operation option:

- ☒ Gamma Dose Rate
- ☐ Shield Thickness
- ☐ Source Strength

Dosimetry & Shielding:

Mode: shield thickness

Mode: source strength

Co60
10.47 m 5.27 y

Dosimetry and Shielding
27 Cobalt

Current Chart: Karlsruhe

Element: Mass:
Co 60 Nuclide Mixtures Selector

Dosimetry and Shielding Dose rate/Thickness graph Options

Source strength
Activity(Bq) 100E+06

Shielding material
Pb ??? cm

Dose rate (μSv/h)
2

Source Shield Detector

Source/detector distance (cm)
200

Start Reset

Co60
10.47 m 5.27 y

Dosimetry and Shielding
27 Cobalt

Current Chart: Karlsruhe

Element: Mass:
Co 60 Nuclide Mixtures Selector

Dosimetry and Shielding Dose rate/Thickness graph Options

Source strength
Activity(Bq) ???

Shielding material
Pb cm

Dose rate (μSv/h)

Source Shield Detector

Source/detector distance (cm)
200

Start Reset

Exercises! Dosimetry & Shielding

Mode: gamma dose rate

- What is the dose rate from a 100 MBq source of Co-60 at 2m distance without and with 5 cm lead shielding?

Mode: shield thickness

- What thickness of lead is required to reduce the dose rate to 2 $\mu\text{Sv/h}$ at a distance of 2 m from the source?

Mode: source strength

- A dose rate of 5 $\mu\text{Sv/h}$ is measured behind a 6 cm lead shield. It is known that the source is Co-60 and that the source detector distance is 2m. What is the activity of this source?

Exercises! Dosimetry & Shielding

Mode: gamma dose rate

- What is the dose rate from a 100 MBq source of Co-60 at 2m distance without and with 5 cm lead shielding? (ans. 8.4 $\mu\text{Sv/h}$, 0.84 $\mu\text{Sv/h}$)

Mode: shield thickness

- What thickness of lead is required to reduce the dose rate to 2 $\mu\text{Sv/h}$ at a distance of 2 m from the source? (ans. 3.46 cm Pb)

Mode: source strength

- A dose rate of 5 $\mu\text{Sv/h}$ is measured behind a 6 cm lead shield. It is known that the source is Co-60 and that the source detector distance is 2m. What is the activity of this source? (ans. 1 GBq)